

9 | WATER SYSTEM IMPROVEMENTS

INTRODUCTION

This chapter presents proposed improvements to the City of Kent's (City) water system that are necessary to resolve existing system deficiencies and accommodate the projected growth of water customers. The water system improvements were identified from an evaluation of the results of the water system analyses presented in [Chapter 7](#). The water system improvements were sized to meet both the existing and future demand conditions of the system.

A Capital Improvement Program (CIP) number has been assigned to each improvement identified by the City. Numbers assigned to the improvements start at the west end of the system and generally increase incrementally to the east, as shown in [Figures 9-1](#) through [9-7](#), which are plan views of the improvements. A brief description of the extents shown in these figures is as follows.

- [Figure 9-1](#): System-Wide
- [Figure 9-2](#): West Hill
- [Figure 9-3](#): 240 Zone – West
- [Figure 9-4](#): 240 Zone – Downtown
- [Figure 9-5](#): 240 Zone – North
- [Figure 9-6](#): East Hill – North
- [Figure 9-7](#): East Hill – South

The improvements also are illustrated in the hydraulic profile of the future water system ([Figure 9-8](#)). The improvements are organized and presented in this chapter according to the following categories.

- Recent Water System Improvements
- Water Main Improvements
- Pressure Zone Improvements
- Facility Improvements
- Miscellaneous Improvements

The remainder of this chapter presents a brief description of each group of improvements, the criteria for prioritization, the basis for the cost estimates, and the schedule for implementation.

DESCRIPTION OF IMPROVEMENTS

This section provides a general description of each group of improvements and an overview of the deficiencies they will resolve. Most of the improvements are necessary to resolve existing system deficiencies.

RECENT WATER SYSTEM IMPROVEMENTS

The water system has undergone several changes since 2011, when the City last updated its Water System Plan (WSP). **Table 9-1** lists the major water system CIP projects that have been completed since 2011.

Table 9-1
Major Improvements Completed Since 2011 WSP

Project Description	Year Completed
640 Tank Construction	2011
Guiberson Corrosion Control Facility	2011
Pump Station #6 Emergency Generator Transfer Switch Installation	2011
Clark Springs Surge Tank Electrical Upgrade	2012
Pump Station #5 Control Valve Auma Replacements	2012
Pump Station #7 Mag Meter Replacement	2012
Pump Station #7 Generator Set Installation	2012
Cambridge Tank Overflow and Drain Improvements	2012
Blue Boy Standpipe Piping and Control Vault Improvements	2012
Armstrong Springs Chlorination Equipment Upgrade	2013
East Hill Well Generator Set Installation	2013
Clark Springs Well #1 MCC Replacement	2015
City of Tacoma Green River Filtration Facility	2015
Kent Springs Gallery Level Sensor and Chlorination Equipment Installation	2015
Pump Station #5 MCC Upgrade and Installation of Soft Starts for Pumps 3 and 4	2015
212th Street Treatment Plant Mag Meter Upgrade and Auma Valve Control Actuator Installation	2016
Armstrong Springs Wells Back-up Generator with MCC Installation	2016
Armstrong Springs Wells Property Purchase for Source Protection	2016
Pump Station #5 Control Vault Upgrades for 125K Tank	2016
6 MG #2 Reservoir Hatch Security Improvements	2016
Guiberson Reservoir Lining, Manifold, and Security Improvements	2016
3.5 MG Tank Drain and Control Vault Installation, and Flow Meter Installation	2016
East Hill Well Redevelopment and Pump and Motor Replacement	2017
3.5 MG Tank Cleaning, Inspection, and PAX Mixer Replacement	2017
Clark Springs Habitat Conservation Measure #6 – Rock Creek Woody Debris	2017
Clark Springs Watershed Property Purchase for Source Protection (Gribble Property)	2017
Guiberson Reservoir Exterior Coating	2017
Kent Springs Overflow Box Vault Lid Installation	2017
Kent and Lake Meridian Water District Intertie #3 Vault and Meter Upgrade	2017
Pump Station #8 Generator Hook-Up and Transfer Switch Installation	2017
Reith Road Tank Cleaning and Inspection	2017
485 Individual Customer PRVs Installed for Future 640 Zone Conversion	2018
6 MG #1 Reservoir Exterior Cleaning	2018
640 Tank Interior Cleaning and Inspection	2018
Clark Springs Augmentation Meter Upgraded	2018
Clark Springs Manual Generator Hook-Up Installed for Secondary Emergency Power	2018
Clark Springs Rock Creek Augmentation Pump Rebuilt and Replaced	2018
Clark Springs Wells 1, 2, and 3 Waste Discharge Line Flow Meter Installed	2018
Gribble Property Monitoring Well Drilled for Sampling South of the Landsburg Mine	2018
SCADA Security Study Performed with Department of Homeland Security	2018
640 Zone Conversion Improvements	2011-Ongoing

WATER MAIN IMPROVEMENTS

The following water main improvements were identified from the results of the distribution and transmission system analyses discussed in [Chapter 7](#) to meet the City’s 2019 design criteria. Some of the water main improvements will replace existing distribution water main and are grouped in the “Annual Water Main Replacement Program – High Priority” project (CIP WM1). The individual water main improvement projects within this group are numbered 1 through 55, as shown in [Figures 9-9](#) through [9-15](#). Medium and low priority projects were not identified with a CIP number, but they are shown in [Figures 9-9](#) through [9-15](#). Other water main improvements are mostly larger diameter water mains that function more like transmission mains than distribution mains and are identified by the City as individual projects (CIP WM2 through WM13).

CIP WM1: Annual Water Main Replacement Program – High Priority

Deficiency: Most of the water main improvements shown in [Figures 9-9](#) through [9-15](#) are required to resolve existing system fire flow deficiencies based on 2019 design criteria for new construction and are caused primarily by undersized water mains. Some of the water main improvements address aging water main materials, such as asbestos cement (AC) and cast iron (CI). Many areas also have known occurrences of water main leaks or breaks.

Improvement: Replace existing water main with new water main in accordance with the City’s construction standards. The individual water main improvements grouped under this project are numbered 1, 2, 3, etc., as shown in [Figures 9-9](#) through [9-15](#). The selection of specific projects will be accomplished annually during the City’s budget development process and guided by the prioritization presented later in this chapter. This provides the City with the flexibility to coordinate these projects with other projects that may occur within the same area. An average allowance of approximately \$2,200,000 per year has been established for the annual replacement of water mains.

CIP WM2: Veterans Drive and Military Road Transmission Main

Deficiency: A single transmission main in Meeker Street crosses the Green River to connect the City’s supply facilities to the City’s West Hill operating area. A secondary transmission main is proposed to be installed to provide a redundant conveyance route to the West Hill operating area.

Improvement: The proposed main is recommended to be 16-inch-diameter to meet the future supply needs of the West Hill operating area and for compatibility with the proposed [CIP F1: West Hill BPS](#) capacity. The alignment of the proposed main is proposed to be within Veterans Drive, between a future West Hill BPS located immediately east of the Green River and Military Road, and primarily within Military Road, between Veterans Drive and a future West Hill Reservoir located at approximately S 248th Street. It is recommended that this project be designed and constructed in conjunction with CIP F1: West Hill BPS. This project location is shown on [Figure 9-2](#).

CIP WM3: Reith Road Transmission Main Improvements

Deficiency: The existing 8-inch-diameter main in Reith Road between 42nd Avenue S and 38th Avenue S is undersized and does not provide sufficient fire flow to the 529 Zone.

Improvement: Replace the existing main in this location with 16-inch-diameter main. This project location is shown on [Figure 9-2](#).

CIP WM4: 68th Avenue S Transmission Main Improvements

Deficiency: The existing main in 68th Avenue S between James Street and S 190th Street is predominantly constructed of concrete and is over 50 years old. The water main has likely reached or is approaching the end of its design life. Additionally, a *Seismic Vulnerability Assessment*, prepared in 2017 by Kennedy/Jenks Consultants, recommends that key transmission main in the City's 240 Zone be upgraded with the installation of seismically restrained main to prevent service interruptions following a seismic event.

Improvement: Replace the existing main in this location with 12- and 16-inch-diameter main. It is recommended that the replacement main be seismically restrained water main. This project location is shown on [Figures 9-3, 9-4, and 9-5](#).

CIP WM5: S 212th Street Transmission Main Improvements

Deficiency: The existing main in S 212th Street between Russell Road and 84th Avenue S is over 50 years old and has likely reached or is approaching the end of its design life. Additionally, a *Seismic Vulnerability Assessment*, prepared in 2017 by Kennedy/Jenks Consultants, recommends that key transmission main in the City's 240 Zone be upgraded with the installation of seismically restrained main to prevent service interruptions following a seismic event.

Improvement: Replace the existing main in this location with 16-inch-diameter main. It is recommended that the replacement main be seismically restrained water main. This project location is shown on [Figures 9-3 and 9-5](#).

CIP WM6: 84th Avenue S Transmission Main Improvements

Deficiency: The existing main in 84th Avenue S between S 228th Street and S 192nd Street is predominantly constructed of concrete and is over 60 years old. The water main has likely reached or is approaching the end of its design life. Additionally, a *Seismic Vulnerability Assessment*, prepared in 2017 by Kennedy/Jenks Consultants, recommends that key transmission main in the City's 240 Zone be upgraded with the installation of seismically restrained main to prevent service interruptions following a seismic event.

Improvement: Replace the existing main in this location with 16-inch-diameter main. It is recommended that the replacement main be seismically restrained water main. This project location is shown on [Figure 9-5](#).

CIP WM7: Guiberson Reservoir Transmission Main Improvements

Deficiency: The Guiberson Reservoir has two primary transmission mains to convey water to the 240 Zone. The transmission main that conveys water west from the Guiberson Reservoir is

located primarily within easements, is difficult to access, and is located on a steep slope that has been the location of a historical landslide (Figure 2-2, *Seismic Vulnerability Assessment*, Kennedy/Jenks Consultants, 2017).

Improvement: Abandon the existing transmission main to the west of the Guiberson Reservoir, between approximately Kennebeck Avenue and Central Avenue S. Replace the existing transmission main to the north of the Guiberson Reservoir with 24-inch-diameter main in Kennebeck Avenue, between Guiberson Street and E Titus Street, and in E Titus Street between Kennebeck Avenue and Central Avenue S. It is recommended that the replacement main be seismically restrained water main. This project location is shown on [Figure 9-4](#).

CIP WM8: 78th Avenue S Water Main Improvements

Deficiency: The existing 8-inch-diameter main in 78th Avenue S between approximately S 262nd Street and S 277th Street is undersized and does not provide sufficient fire flow to existing customers served by the looped main in this location.

Improvement: Replace the existing main in this location with 12-inch-diameter main. This project location is shown on [Figure 9-4](#).

CIP WM9: 88th Avenue S Water Main Improvements

Deficiency: No water main currently exists in 88th Avenue S between S 218th Street and approximately S 222nd Street.

Improvement: Install 12-inch-diameter main in this location. This project location is shown on [Figure 9-5](#).

CIP WM10: S 218th Street Transmission Main Improvements

Deficiency: The existing 12-inch-diameter main in S 218th Street between the 6 Million Gallon #2 (6 MG #2) Reservoir located at Garrison Creek Park and 88th Avenue S is undersized and does not provide sufficient fire flow to the 240 Zone.

Improvement: Replace the existing main in this location with 18-inch-diameter main. It is recommended that the replacement main be seismically restrained water main. In addition to the transmission main improvement, evaluate the reconfiguration of the S 218th Street pressure reducing valve (PRV) to allow the City to convey water directly to the 240 Zone from the 6 MG #2 Reservoir Transmission Main in the event that the 6 MG #2 Reservoir is out of service, or to wheel City of Tacoma water directly into the 240 Zone. This project location is shown on [Figure 9-5](#).

CIP WM11: SE 284th Street Water Main Improvements

Deficiency: Additional conveyance capacity between the City of Tacoma (Tacoma) Point of Delivery (POD) #3 and the 590 Zone will be necessary following creation of the 640 Zone, which will truncate some existing distribution main in the east side of the existing 590 Zone.

Improvement: Install 12-inch-diameter main in SE 284th Street between 118th Avenue SE and 109th Avenue SE, and in 108th/109th Avenue SE between SE 284th Street and SE 279th Street. This project location is shown on [Figure 9-7](#).

CIP WM12: 640 Zone BPS #2 Transmission Main Improvements

Deficiency: The City is converting the easterly portion of the existing 590 Zone to the 640 Zone, which will be supplied by two future BPSs. Transmission from the proposed 640 BPS #2 (CIP F5), proposed to be located at the Tacoma POD #3 site, will be required to connect the proposed BPS with the 640 Zone distribution system.

Improvement: Install 18-inch-diameter 640 Zone main in 118th Avenue SE between SE 284th Street and SE 277th Place, in SE 277th Place between 118th Avenue SE and 120th Avenue SE, and in 120th Avenue SE between SE 277th Place and SE 272nd Place. The proposed 18-inch-diameter main in 120th Avenue SE between SE 276th Street and SE 272nd Place is proposed to replace the existing 6- and 8-inch-diameter main in the same location.

Replace existing 8-inch-diameter main in SE 272nd Place between 116th Place SE and 102nd Avenue SE with 12-inch-diameter 640 Zone main.

Replace existing 4-inch-diameter main in 117th Avenue SE between SE 276th Street and SE 272nd Place with 8-inch-diameter 640 Zone main.

Convert approximately 800 linear feet of existing 18-inch-diameter 590 Zone main in SE 288th Street between the Tacoma POD #3 and 118th Avenue SE, and approximately 1,500 linear feet of existing 24-inch-diameter 590 Zone main in 118th Avenue SE between SE 288th Street and SE 284th Street SE to 640 Zone main.

Isolate the proposed 590 and 640 Zones near the vicinity of these proposed improvements with zone valves. This project location is shown on [Figure 9-7](#).

CIP WM13: 590 Zone Transmission Main Downstream of Tacoma POD #3

Deficiency: The City is converting the easterly portion of the existing 590 Zone to the 640 Zone, and the existing 18-inch-diameter 590 Zone main in SE 288th Street is proposed to be converted to 640 Zone main as part of CIP WM16. Additional conveyance capacity from Tacoma POD #3 to the 590 Zone will be necessary following the conversion of the existing 590 Zone main.

Improvement: Install 12-inch-diameter 590 Zone main within an easement in approximately 120th Avenue SE between Tacoma POD #3 and SE 284th Street. Replace the existing 8-inch-diameter 590 Zone main in SE 284th Street between approximately 120th Avenue SE and 124th Avenue SE with 12-inch-diameter 590 Zone main. This project location is shown on [Figure 9-7](#).

Future Water Main Extensions and Replacements

All new water main extensions and replacements shall be installed in accordance with the City's Water System Standard Plans, which are included in [Appendix G](#). All new water mains shall be sized by hydraulic analysis to ensure that all pressure, flow, and velocity requirements stated in [Chapter 5](#) are met. In general, new and replacement water mains that will carry fire flow in

residential areas shall be a minimum of 8 inches in diameter and looped for multi-family and residential developments. New and replacement water mains in commercial, business park, industrial, and school areas shall be a minimum of 12 inches in diameter and looped.

PRESSURE ZONE IMPROVEMENTS

The following pressure zone improvements will improve the reliability and redundancy to vulnerable locations throughout the water system and will improve various low and high pressure problem areas throughout the water system. A brief description of the existing deficiency and the improvement itself is provided in the following sections.

CIP PZ1: Military Road Connection Between 587 and 575 Zones

Deficiency: The City's West Hill operating area includes independent 587 and 575 Zones, each of which are closed pressures zones that are supplied by separate BPSs. During a fire flow or emergency event, the hydraulic grade of these pressure zones is reduced, and the zones are supplied via the 529 Zone.

Improvement: A transmission main is proposed to be installed within Military Road to connect the 587 and 575 Zones to improve redundancy and reliability of these zones, and to convert both zones to open zones with the same hydraulic grade (587 feet) following the completion of a future West Hill Reservoir. The proposed main is recommended to be 12 inches in diameter, and to be installed primarily within Military Road, between approximately S 257th Street and S 264th Street, where the transmission main is proposed to extend to the Cambridge Tank and Pump Station #7 site and connect to the existing 575 Zone main on the discharge side of Pump Station #7. Following this improvement, supply to the converted 575 Zone will primarily be from 587 Zone facilities, with Pump Station #7 operating as backup supply. Operational controls for Pump Station #6 and Pump Station #7 should be adjusted accordingly. This project location is shown on [Figure 9-2](#).

CIP PZ2: 640 Zone Conversion

Deficiency: The City is converting the easterly portion of the existing 590 Zone to the 640 Zone and will require multiple PRV stations to continue to provide a sufficient level of service to the 590 Zone following the pressure zone conversion, closed valves to separate the 590 and 640 Zones, and the installation of individual PRVs for customers that will experience an increase in service pressures for those that exceed 80 pounds per square inch (psi).

Improvement A (116th Avenue and SE 272nd Place): Install a PRV station at the westerly SE 272nd Place dead-end, between 116th Avenue SE and 116th Place SE. Install 12-inch-diameter water main between the proposed PRV and the existing 10-inch-diameter 590 Zone main at the intersection of 116th Avenue SE and 114th Avenue SE. A modified version of this improvement was originally identified in a *640 Zone Creation Report*, prepared by RH2 Engineering, Inc., (RH2) in July 2008, and was subsequently included in the analyses presented in a *640 Zone Phasing Analysis Technical Memorandum*, prepared in August 2016 by PACE Engineers, Inc. This project location is shown on [Figure 9-7](#).

Improvement B (SE 270th Street): Install a PRV station in SE 270th Street, immediately east of the intersection with 120th Avenue SE. This improvement was originally identified in a *640 Zone Creation Report*, prepared by RH2 in July 2008, and was subsequently included in the analyses presented in a *640 Zone Phasing Analysis Technical Memorandum*, prepared in August 2016 by PACE Engineers, Inc. This project location is shown on [Figure 9-7](#).

Improvement C (116th Avenue SE): Install a PRV station in 116th Avenue SE at approximately SE 270th Street. This improvement was originally identified in a *640 Zone Creation Report*, prepared by RH2 in July 2008, and was subsequently included in the analyses presented in a *640 Zone Phasing Analysis Technical Memorandum*, prepared in August 2016 by PACE Engineers, Inc. This project location is shown on [Figure 9-7](#).

Improvement D (SE 265th Street): Install a PRV station in SE 265th Street, between 114th Place SE and 115th Place SE. This improvement was originally identified in a *640 Zone Creation Report*, prepared by RH2 in July 2008, and was subsequently included in the analyses presented in a *640 Zone Phasing Analysis Technical Memorandum*, prepared in August 2016 by PACE Engineers, Inc. This project location is shown on [Figure 9-6](#).

Improvement E (SE 248th Street): Install a PRV station in SE 248th Street just east of the intersection with 110th Avenue SE. This improvement was originally identified in a *640 Zone Creation Report*, prepared by RH2 in July 2008, and was subsequently included in the analyses presented in a *640 Zone Phasing Analysis Technical Memorandum*, prepared in August 2016 by PACE Engineers, Inc. This project location is shown on [Figure 9-6](#).

Improvement F (Valve Closures): Close existing in-line valves at the following locations, and install and close new in-line valves at the following locations if a valve is not currently installed at these locations. The list of zone valves starts in the south end of the existing 590 Zone and increase to the north.

- Between the two 116th Place SE cul-de-sacs.
- In SE 276th Street at the intersection with 116th Place SE.
- At the intersection of 120th Avenue SE and SE 276th Street.
- At the intersection of 120th Avenue SE and SE 272nd Street.
- In SE 266th Street, just west of the intersection with 116th Avenue SE.
- In the southwest corner of the Aspen Grove Condominium property, along the 8-inch-diameter main that connects 116th Avenue SE and 114th Avenue SE.
- In State Route (SR) 516 (Kent Kangley Road) on the east side of the intersection with 114th Avenue SE.
- In SE 256th Street between 113th Avenue SE and 114th Avenue SE.
- On the north side of SE 256th Street between 111th Avenue SE and 111th Place SE to convert the existing main installed within an easement at this location to a dead-end 640 Zone main.

- At the intersection of SE 252nd Street and 113th Avenue SE.
- At the intersection of SE 252nd Street and 111th Avenue SE (close two valves at this location).
- In SE 244th Street between 110th Place SE and 111th Avenue SE.
- In SE 240th Street at approximately 110th Avenue SE.
- At the intersection of 110th Avenue SE and SE 238th Street.
- In 108th Avenue SE between SE 236th Place and SE 236th Street.
- At the intersection of SE 236th Street and 108th Avenue SE.
- In SE 235th Street, just west of the intersection with 109th Avenue SE.
- At the intersection of SE 232nd Place and 108th Avenue SE (and activate the existing PRV at this same location).
- At the intersection of SE 232nd Street and 106th Place SE.
- At approximately 22900 106th Place SE.
- At the intersection of 108th Avenue SE and SE 228th Street/108th Avenue SE.

Improvement G (Individual PRVs): Install approximately 400 individual PRVs for customers in the proposed 640 Zone that will experience service pressures in excess of 80 psi.

FACILITY IMPROVEMENTS

The following water system facility improvements were identified from the results of the water system analyses that are discussed in [Chapter 7](#). The improvements are primarily necessary to resolve existing system deficiencies, but also have been sized to accommodate projected growth.

CIP F1: West Hill BPS

Deficiency: Pump Station #3 is the only non-emergency supply facility for the City's West Hill operating area, and the suction main for Pump Station #3 is installed on the Meeker Street Bridge, which has been identified as a seismically vulnerable bridge. In the event that the main on the Meeker Street Bridge is out of service, or Pump Station #3 is out of service, the only supply available to the City's West Hill operating area is via an emergency intertie with the Highline Water District.

Improvement: Construct the West Hill BPS on Veterans Drive, east of the Green River. The proposed BPS will have a firm capacity capable of providing at least the projected 20-year maximum day demand (MDD) of the West Hill operating area, calculated to be 847 gallons per minute (gpm) in [Chapter 7](#). This capacity assumes that [CIP F2: West Hill Reservoir](#) is completed before, or in conjunction with, the proposed West Hill BPS project. Therefore, the proposed West Hill BPS will normally pump to an open zone and will not be required to provide the fire flow requirement or peak hour demand (PHD) of the West Hill operating area. However, if the City would like to plan for temporary operations or maintenance conditions involving the

proposed West Hill Reservoir being offline, consideration for additional pumping capacity and equipping the proposed pumps with variable frequency drives (VFDs) is recommended to be evaluated during the preliminary design phase of the project. A stationary emergency generator with an automatic transfer switch is recommended to be installed at the West Hill BPS to maintain service in the event of a power outage. The number of pumps, their capacities, and configuration should be determined during the preliminary design phase of the project. For the purposes of this WSP, the West Hill BPS was assumed to consist of two pumps, each capable of providing at least 1,000 gpm to exceed the projected 20-year MDD of the West Hill operating area. It is recommended that this project be designed and constructed in conjunction with **CIP WM2: Veterans Drive and Military Road Transmission Main**, and that the sizing and configuration of the proposed BPS be determined during design of **CIP F2: West Hill Reservoir**. This project location is shown on **Figure 9-2**.

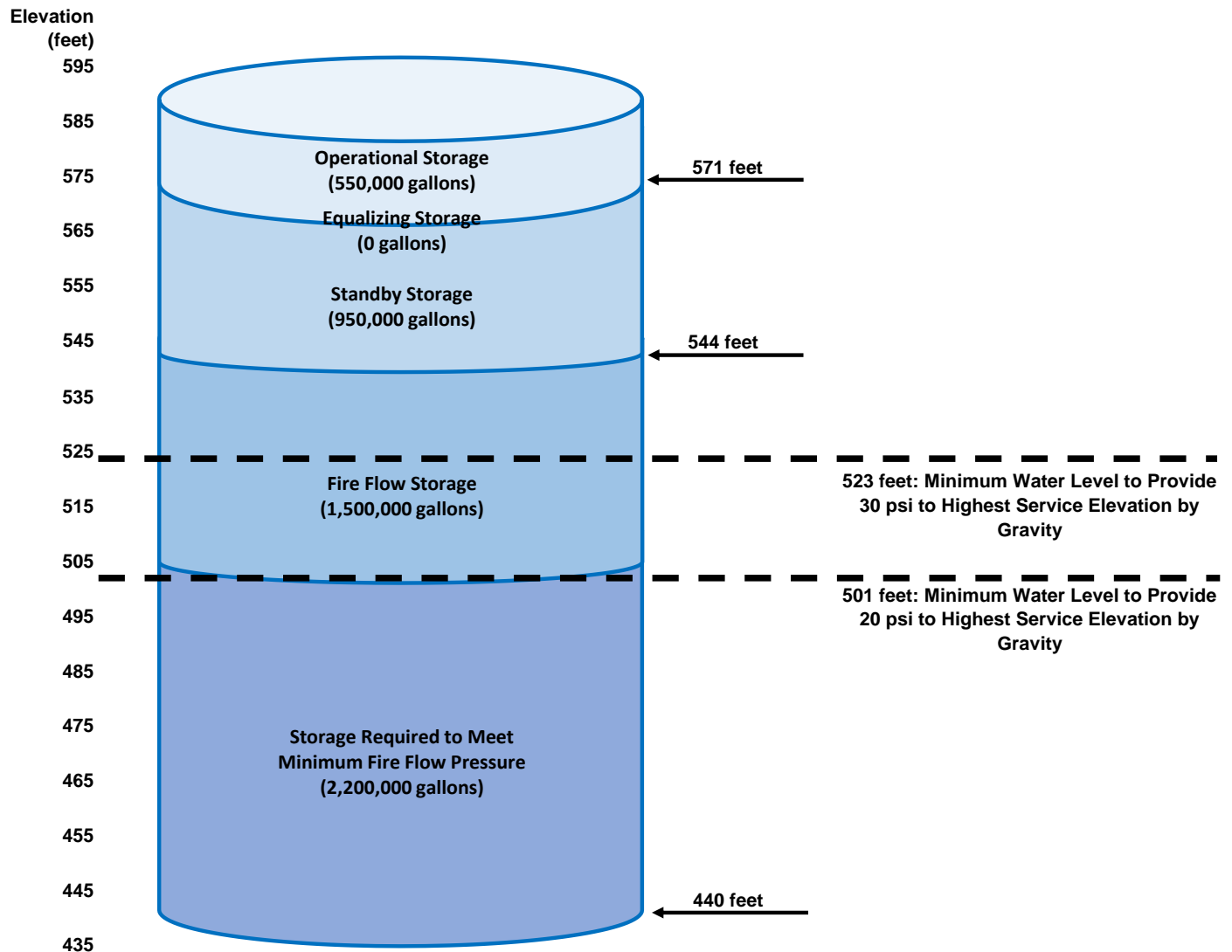
CIP F2: West Hill Reservoir

Deficiency: The West Hill operating area currently consists of four pressure zones, three of which are either closed pressure zones (575 and 587 Zones), or an open pressure zone without sufficient storage capacity to meet the regulatory requirements for the zone (529 Zone). In the event that the pump stations supplying these zones are out of service, or if a fire event occurs, the level of service provided to customers in these zones decreases significantly and can be reduced below regulatory and City's minimum standards.

Improvement: Construct a West Hill Reservoir to provide sufficient water storage for the West Hill operating area beyond the 20-year planning period, calculated to be 2.72 million gallons (MG) of usable storage in **Chapter 7**. To accommodate growth beyond the 20-year planning period presented in this WSP, the City is proposing to construct the West Hill Reservoir with approximately 10 percent additional usable storage volume, resulting in approximately 3.00 MG of usable storage proposed for the West Hill Reservoir.

During the preparation of this WSP, the City was evaluating multiple sites for the proposed West Hill Reservoir and considering standpipe and composite tank configurations for the proposed reservoir. For the purposes of this WSP, the future West Hill Reservoir was assumed to be a standpipe located at a currently undeveloped property on the West Hill between 38th Avenue S and Military Road S adjacent to S 248th Street.

The existing ground elevation at the future reservoir location is approximately 440 feet, and the minimum water level to provide 20 psi to the highest existing service elevation is approximately 501 feet, resulting in approximately 61 feet of dead storage at the bottom of the proposed reservoir. **Chart 9-1** presents a not-to-scale schematic identifying the approximate elevations and volumes of the proposed West Hill Reservoir storage components.

Chart 9-1: Approximate West Hill Reservoir Storage Component Elevations and Volumes

Based on a minimum usable storage volume of 3.00 MG, a minimum usable water level of 501 feet, and a maximum water level of 587 feet (to match the existing 587 Zone hydraulic grade), the resulting standpipe diameter is calculated to be approximately 78 feet. Constructing the proposed West Hill Reservoir with a maximum water level of 587 feet allows the existing 587 Zone customers to receive the same normal service pressures that are provided currently. However, the existing 587 Zone, and the existing 575 Zone that is proposed to be combined with the 587 Zone, provide pressures to existing customers that is approximately 10 to 20 psi higher than the minimum standards required by the Washington State Department of Health (DOH) and the City's design criteria. Water quality evaluations are recommended to take place during the predesign phase of the project to estimate the time to achieve full water turnover in the reservoir (hydraulic residence time), to review potential mixing-related solutions to minimize stagnation within the proposed reservoir, and to evaluate the need for rechlorination at the proposed reservoir site. It is recommended that this project be designed in conjunction with **CIP F1: West**

Hill BPS and **CIP F3: West Hill PRVs and Altitude Valves**, and constructed at the same time or prior to the West Hill BPS. This project location is shown on **Figure 9-2**.

CIP F3: West Hill PRVs and Altitude Valves

Deficiency: Following construction of the proposed West Hill BPS and Reservoir, the City desires to provide the primary supply to the 529 and 345.5 Zones from the West Hill Reservoir. Installation of PRVs at four locations is recommended to facilitate this operational adjustment and improve fire flow availability downstream of each location.

Improvement: Install a PRV station at the following four locations.

- Within or adjacent to Pump Station #3 (354.5 Zone to 240 Zone).
- Within or adjacent to Pump Station #4 (529 Zone to 354.5 Zone).
- Within or adjacent to Pump Station #6 (587 Zone to 529 Zone).
- Within or adjacent to Pump Station #7 and on the existing Cambridge Tank site (587 Zone to 529 Zone).

The hydraulic grades in the preceding bullets reference the proposed hydraulic grades at these locations, following completion of the proposed West Hill BPS and Reservoir, and the proposed 587 and 575 Zone connection and conversion project (CIP PZ1). Proposed sizing for each PRV station includes a 3-inch PRV for low flows (between 2 and 460 gpm), and an 8-inch PRV for high flows (up to 3,900 gpm) to supplement supply to these zones during a fire flow event. The proposed PRV station within or adjacent to Pump Station #3 allows the Meeker Street transmission main to receive flow from two directions instead of functioning as a dead end, and negates the need for approximately 7,100 linear feet of existing Meeker Street transmission main between Washington Avenue and Pump Station #3 to be replaced with larger diameter main to meet the planning-level fire flow requirement along this alignment. It is recommended that these proposed PRV sizes and flow rates be reviewed during the predesign phase of the **CIP F2: West Hill Reservoir** project.

Altitude valves are recommended to be installed at the existing Reith Road Reservoir and the existing Cambridge Tank locations to prevent reservoir overflows from occurring following installation of the proposed PRV stations. This project location is shown on **Figure 9-2**.

CIP F4: 640 Zone BPS #1 (Blue Boy Standpipe Site)

Deficiency: The City is converting the easterly portion of the existing 590 Zone to the 640 Zone, which will be supplied by two future BPSs.

Improvement: Construct a 640 Zone BPS at the Blue Boy Standpipe site. The proposed BPS will have a firm capacity capable of providing at least the projected 20-year MDD of the 640 Zone, calculated to be 1,132 gpm in **Chapter 7**. A *640 Zone Phasing Analysis Technical Memorandum*, prepared in August 2016 by PACE Engineers, Inc., identified the proposed 640 Zone BPS to include three identical pumps, each equipped with a VFD, and rated for 1,750 gpm at 110 feet total dynamic head (TDH). This project location is shown on **Figure 9-6**.

CIP F5: 640 Zone BPS #2 (Tacoma POD #3 Site)

Deficiency: The City is converting the easterly portion of the existing 590 Zone to the 640 Zone, which will be supplied by two future BPSs.

Improvement: Construct a 640 Zone BPS at the City of Tacoma POD #3 site. The proposed BPS will provide redundant supply to the proposed 640 Zone and the 640 Zone BPS #1 that is proposed at the Blue Boy Standpipe site (CIP F5). To provide full redundancy to the 640 Zone, it is assumed that the 640 Zone BPS #2 will be constructed with the same configuration and capacity as the 640 Zone BPS #1, with three identical pumps, each equipped with a VFD, and rated for 1,750 gpm at 110 feet TDH. This project location is shown on [Figure 9-7](#).

CIP F6: 125K Tank Exterior Recoating

Deficiency: The exterior of the 125K Tank needs to be recoated every 15 to 20 years, based on the typical life of coatings on steel tanks.

Improvement: Thoroughly inspect and sample the exterior coating of the 125K Tank to determine the properties of the existing coating and the extent of the required recoating. Recoat the exterior to prevent premature corrosion of the tank exterior. This project location is shown on [Figure 9-6](#).

CIP F7: Guiberson Reservoir Replacement

Deficiency: The Guiberson Reservoir was constructed in the 1930s and is nearing the end of its useful life. Although multiple upgrades have taken place, the Guiberson Reservoir roof and floor are deficient, and it is recommended that a replacement reservoir be constructed.

Improvement: Construct a new reservoir to replace the existing Guiberson Reservoir, with a usable storage volume of approximately 8 to 10 MG, which exceeds the 240 Zone storage volume requirements for the 20-year planning period, as shown in [Chapter 7](#). It is anticipated that the same treatment processes that occur at the existing Guiberson Reservoir will occur at the replacement reservoir, including pH adjustment of water from the Kent Springs Transmission Main by aeration and a sodium hydroxide pH adjustment process. This project location is shown on [Figure 9-4](#).

CIP F8: Garrison/O'Brien Treatment Plant

Deficiency: Water pumped from the O'Brien Well has high concentrations of iron and manganese that results in discolored water immediately downstream of the well. The City elects to not normally operate the O'Brien Well due to the poor aesthetics of the source water.

Improvement: Construct a packaged treatment plant capable of treating the high concentrations of iron and manganese at the O'Brien Well. It is anticipated that the treatment plant will be sized to treat the combined capacity of the Garrison Creek Well and the O'Brien Well to allow raw water from the O'Brien Well to be blended prior to treatment. This project location is shown on [Figure 9-5](#).

MISCELLANEOUS IMPROVEMENTS

The following improvements are planning efforts and program elements that are required to comply with various State of Washington water regulations or other miscellaneous improvements that have been identified as necessary for continued safe and reliable operation of the water system.

CIP M1: Generator Improvement Program

Deficiency: Not all of the City's water system facilities are equipped with temporary or permanent back-up power, and the City's existing generators require regular maintenance.

Improvement: Improve the back-up power capabilities throughout the water system on an ongoing basis.

CIP M2: Reservoir Maintenance and Improvement Program

Deficiency: The City's reservoirs require regular maintenance including, but not limited to, interior and exterior coatings, inspections, piping improvements, and seismic improvements.

Improvement: Maintain and improve the reservoirs as necessary.

CIP M3: Tacoma Regional Water Supply System (RWSS)

Deficiency: The City's interties with the City of Tacoma pipeline require ongoing improvements.

Improvement: Perform improvements related to the City of Tacoma interties and pipeline as necessary.

CIP M4: Transmission Main Easements/Land Acquisitions

Deficiency: Not all transmission mains have adequate easement width for maintenance and repair.

Improvement: The City will work to acquire necessary easements to allow for maintenance and repair.

CIP M5: Water System Plan Update

Deficiency: Washington Administrative Code (WAC) 246-290-100 requires that the City's WSP be updated every 10 years and submitted to DOH for review and approval.

Improvement: The City will update and submit its WSP every 10 years to comply with State requirements.

CIP M6: Watershed Control Plan, Habitat Conservation Plan, and Wellhead Protection Program

Deficiency: The Watershed Control Plan, Habitat Conservation Plan, and Wellhead Protection Program require ongoing management and updates.

Improvement: The City will update and implement the Watershed Control Plan, Habitat Conservation Plan, and Wellhead Protection Programs in accordance with State requirements.

CIP M7: Landsburg Mine Management

Deficiency: The Landsburg Mine is located upstream of Clark Springs and contains toxic contaminants.

Improvement: The City manages and coordinates Landsburg Mine clean-up plans, which are anticipated to be an ongoing effort.

CIP M8: Automatic Meter Reading System

Deficiency: The City desires to evaluate the feasibility of, and to implement, an automatic meter reading (AMR) system for the City's water system meters.

Improvement: The City will evaluate the feasibility of an AMR system, and if deemed viable, will implement and install an AMR system. Benefits of an AMR system are likely to include the following.

- Elimination of cyclical manual meter reading costs.
- Reduced billing expenses.
- Reduced fuel, fleet maintenance, and labor costs.
- Increased understanding of baseline and peak demands in smaller areas to assist with water system planning and identification of system losses.
- Identification of oversized meters that subsequently under-report consumption.
- Detection of reverse water flow and tampering.
- Information for customers regarding abnormal consumption potentially indicative of leaks, and the ability to provide customers access to their own data in hourly or daily intervals to allow customers to better understand their own usage.

CIP M9: PLC Upgrade Program

Deficiency: The City's programmable logic controllers (PLC) require ongoing upgrades and improvements.

Improvement: Maintain and improve the system's PLCs as necessary to facilitate continued connectivity and control of water system facilities.

CIP M10: SCADA System Upgrades

Deficiency: The City's supervisory control and data acquisition (SCADA) system software and hardware require upgrades to enhance its capabilities and reliability.

Improvement: Upgrade the SCADA system software and hardware as necessary to facilitate continued connectivity and control of water system facilities.

CIP M11: Well Rehabilitation Program

Deficiency: The City's wells require ongoing maintenance and rehabilitation to allow them to continually provide reliable supply to the City's system.

Improvement: Perform well maintenance and rehabilitation of approximately two wells on an annual basis. Typical tasks associated with this improvement include removing the well pump and motor from the well casing; inspecting the equipment condition and performing repairs or rebuilding equipment as necessary; performing a video inspection of the well casing; and reinstalling the equipment and returning the well(s) to service.

ESTIMATING COSTS OF IMPROVEMENTS

Project costs for the proposed improvements were estimated based on costs of similar, recently constructed water projects in the City and around the Puget Sound area and are presented in 2019 dollars. The project cost estimates include the estimated construction cost of the improvement, as well as indirect costs estimated at 35 percent of the construction cost for engineering preliminary design, final design, and construction management services, permitting, legal, and administrative services. The project cost estimates include a 20-percent contingency and sales tax of 10.0 percent.

Project cost estimates for water main projects were determined from the water main unit costs (i.e., cost per foot length) shown in [Table 9-2](#) and the proposed diameter and approximate length of each improvement.

Table 9-2
Water Main Unit Costs

Water Main Diameter (inches)	Project Cost per Foot Length (2019 \$ per LF)
Standard Piping	
8	\$317
12	\$350
16	\$383
18	\$417
21	\$453
24	\$492
Seismically Restrained Piping	
8	\$633
12	\$700
16	\$766
18	\$833
21	\$906
24	\$984

The unit costs for each water main size are based on estimates of construction-related improvements, such as materials and labor for the water main installation, water services, fire hydrants, fittings, valves, connections to the existing system, trench restoration, asphalt surface restoration, other work necessary for a complete installation, contingency, and sales tax.

Additional costs were added to some water main improvements to cover anticipated, increased costs related to the project location and degree of difficulty.

PRIORITIZING IMPROVEMENTS

The water system improvements were prioritized from established criteria to formulate a schedule that identifies projects with the most deficiencies and greatest need for improvement to be completed prior to projects with fewer deficiencies. A description of the criteria and method for prioritizing each category of improvements is provided in the following sections.

WATER MAIN IMPROVEMENTS

Table 9-3 lists criteria that were established for prioritizing the water main improvements. The criteria are based on the underlying deficiencies of the existing water main that will be replaced by the proposed water main improvements. The criteria are arranged in seven different categories with a weight factor assigned to each category. The criteria given the most weight are the Seismic Vulnerability, the Proximity to Critical Slopes, the Existing Water Main Maintenance/Breaks, and the Existing Water Main Fire Flow Capability categories.

The Seismic Vulnerability category ranks the water main improvements based on the vulnerability of the water main during a M9.0 seismic event, as identified in the *Seismic Vulnerability Assessment* prepared by Kennedy/Jenks Consultants in April 2017. The Proximity to Critical Slopes category ranks the water main improvements based on the slope of the ground surface adjacent to the water main, based on the 10-foot contour data provided by the City. The Existing Water Main Maintenance/Breaks category ranks the water main improvements based on the number of reported leaks or breaks that the City currently has on record. The Existing Water Main Fire Flow Capability category ranks the water main improvements based on the ability of the existing water mains to provide the required fire flow, as determined from the results of the hydraulic analyses in **Chapter 7**. The Existing Water Main Material category ranks the water main improvements based on the material of the existing water main. The Existing Water Main Year of Installation category ranks the water main improvements based on the age of the existing water mains. The Existing Water Main Benefit Area category ranks the water main improvements based on the size of the area that will benefit from the replacement.

Table 9-3
Water Main Improvements Priority Ranking Criteria

Points	Category	Weight Factor	Weighted Points
Seismic Vulnerability¹			
5	High Vulnerability (Net Repair Rate > 0.27)	3	15
3	Medium Vulnerability (Net Repair Rate between 0.16 and 0.27)	3	9
0	Low Vulnerability (Net Repair Rate < 0.16)	3	0
Proximity to Critical Slopes			
5	Steep Slopes (Slope Exceeds 30%)	3	15
3	Medium Slopes (Slopes Between 15-30%)	3	9
0	Gentle or Flat Slopes (Slopes Less Than 15%)	3	0
Existing Water Main Maintenance/Breaks			
5	High Maintenance Requirements/High Frequency of Recent Breaks	3	15
3	Annual Maintenance/Recent History of Breaks	3	9
0	No Maintenance and No History of Problems	3	0
Existing Water Main Fire Flow Capability			
5	Derated Fire Flow is 59% or less of Required Fire Flow	3	15
4	Derated Fire Flow is 60-69% of Required Fire Flow	3	12
3	Derated Fire Flow is 70-79% of Required Fire Flow	3	9
2	Derated Fire Flow is 80-89% of Required Fire Flow	3	6
1	Derated Fire Flow is 90-99% of Required Fire Flow	3	3
0	Derated Fire Flow is 100% of Required Fire Flow	3	0
Existing Water Main Material			
5	Galvanized or Steel	2	10
4	Asbestos Cement	2	8
3	Cast Iron or Unknown	2	6
2	Copper	2	4
1	HDPE	2	2
0	Ductile Iron or PVC	2	0
Existing Water Main Year of Installation			
5	Before 1950	2	10
4	1950-1959	2	8
3	1960-1969	2	6
2	1970-1979	2	4
1	1980-1989	2	2
0	After 1989	2	0
Existing Water Main Benefit Area²			
5	Large Benefit Area (greater than 500 gpm)	1	5
4	Large Area Served (250 to 500 gpm)	1	4
3	Medium to Large Area Service (100 to 250 gpm)	1	3
2	Medium Area Served (50 to 100 gpm)	1	2
1	Small to Medium Area Served (25 to 50 gpm)	1	1
0	Small or Localized Area Served (less than 25 gpm)	1	0

(1) Based on the data presented in Figure 2-4A (Estimated Pipe Repair Rate for Three Pipe Categories for the M9.0 CSZ Earthquake Scenario) of the April 2017 *Seismic Vulnerability Assessment* prepared by Kennedy/Jenks Consultants.

(2) Flows based on existing maximum day demands.

The water main priority ranking criteria were applied to the annual water main replacement projects, with the weighted points associated with each project ranging between 1 and 53 points. These projects were categorized as high, medium, and low priority projects, with projects scoring more than 32 points identified as high priority projects, projects scoring between 17 and 32 points identified as medium priority projects, and projects scoring less than 17 points identified as low priority projects. The City will endeavor to complete most of the high priority projects within the 20-year planning period and has grouped these projects within CIP WM1, with the schedule to complete these projects CIP Nos. 1 through 55, as shown in **Figures 9-9** through **9-15**, reflect the projects within CIP WM1, and are generally numbered from west to east throughout the water system. These projects reflect the high priority water main replacement projects necessary to meet the City's 2019 design criteria, and are presented in **Table 9-4** with their weighted point totals.

Table 9-4
High Priority Distribution System Replacement Projects to Meet 2019 Design Criteria

CIP No.	Length (LF)	Prop. Diam. (inches)	Existing Material ¹	Location			Estimated Cost ²	Weighted Points
				In	From	To		
1	1,597	8	CI	S 262nd St, 46th Ave S	43rd Ave S	Kent Ct	\$506,000	35
2	632	16	AC	S Reith Rd	Military Rd S	38th Ave S	\$243,000	34
3	2,902	8	UNK	S 256th St, S 253rd St, 35th Pl S	32nd Pl S	S 252nd Pl	\$919,000	39
4	623	12	CI, UNK	42nd Pl S	S 253rd St	Cul-de-Sac near Reith Road Tank	\$218,000	34
5	2,980	8	AC, CI, DI, UNK	35th Ave S	S 240th St	Military Rd S	\$944,000	43
6	898	8	DI	Between Dead-Ends	W Valley Hwy	S 266th St	\$285,000	--- ³
7	3,247	12	CI, DI	72nd Ave S	Private Property	72nd Ave near Union Pacific Railroad	\$1,137,000	36
8	2,023	12	CI, DI	68th Ave S, W Valley Hwy, Private Property	S 188th St	72nd Ave S	\$708,000	37
9	6,499	12, 16	CI, DI	S 200th St, 81st Ave S, 78th Ave S, S 196th St	84th Ave S	84th Ave S	\$2,261,000	39
10	4,400	12	CI, UNK	Private Property	64th Ave S	Washington Ave S	\$1,540,000	36
11	2,406	12	CI, DI, UNK	W Smith St	64th Ave S	Thompson Ave N	\$842,000	44
12	1,577	12	CI, DI, UNK	68th Ave S, Private Property	S Sent Des Moines Rd	74th Ave S	\$552,000	47
13	1,126	12	DI	Naden Ave S	W Meeker St	SR 516	\$394,000	47
14	606	12	UNK	Madison Ave	W Smith St	W Meeker St	\$213,000	44
15	809	12	DI, UNK	W Harrison St, Thompson Ave N	W Meeker St	Washington Ave N	\$284,000	44
16	3,117	12	AC, CI, DI, UNK	James St	66th Avenue S	5th Avenue N	\$2,182,000	34
17	2,793	8, 12	CI, UNK	3rd Ave S	W Willis St	S 259th St	\$932,000	48
18	2,290	12	CI, DI	5th Ave S, Private Property	3rd Ave S	S 259th St	\$802,000	42
19	818	8	CI, DI	5th Ave S	Rachael Pl	Dead-end near W Overlock	\$259,000	38
20	1,652	12, 16	CI, UNK	E Willis St, W Willis St	4th Ave S	Central Ave S	\$595,000	35
21	1,821	8, 12	DI, UNK	2nd Ave S	W Meeker St	W Crow St	\$599,000	44
22	936	12	UNK	W Titus St	4th Ave S	1st Ave S	\$328,000	33
23	4,817	12, 16	AC, CI, DI	E Meeker St	Central Ave S	Kennebeck Ave S	\$3,412,000	50
24	2,550	12	DI, UNK	E Smith St	N Lincoln Ave	1st Ave N	\$893,000	47
25	1,955	12	CI, DI, UNK	N Lincoln Ave	W James St	W Meeker St	\$685,000	44
26	907	12	CI, DI	5th Ave N, Private Property	Private Property	W James St	\$228,000	40
27	4,103	12	CI, DI, UNK	1st Ave S, 80th Ave S	E Willis St	79th Ave S	\$1,436,000	35
28	293	10	CI	E Morton St	Railroad Ave S	Bridges Ave S	\$103,000	46
29	1,377	10	CI	Railroad Ave S	E Willis St	Dead-end near Private Property	\$482,000	47
30	1,383	12	CI	Bridges Ave S	E Willis St	Dead-end near Private Property	\$484,000	47
31	306	12	CI	E Saar St	Railroad Ave S	Central Ave S	\$108,000	44
32	748	16	DI	Central Ave S	E Titus St	E Willis St	\$287,000	47
33	1,179	12	UNK	1st Ave S	W Meeker St	W Titus St	\$413,000	38
34	1,827	8, 12	CI	State Ave N	E Smith St	Ward St	\$616,000	53
35	420	12	CI	Ward St	State Ave N	Kennebeck Ave S	\$147,000	45
36	1,632	12	AC, CI, DI, UNK	E Smith St	Railroad Ave N	Jason Ave N	\$572,000	46
37	3,239	12, 16	CI, DI	Railroad Ave N	E James St	E Willis St	\$1,155,000	48
38	3,930	12, 16	DI, UNK	4th Ave N	North of W Cloudy St	W Saar St	\$1,418,000	39
39	1,339	8, 12, 16	CI, DI	3rd Ave N	Cole St	W James St	\$449,000	46
40	1,327	8, 12	CI, DI	2nd Ave N	Cole St	W James St	\$443,000	42
41	2,018	12	CI, DI, UNK	1st Ave N	West of Cole St	W James St	\$707,000	46
42	6,685	12, 16	CI, CONC, DI	Central Ave N	S 228th St	E Titus St	\$4,764,000	47
43	717	12, 16	CI, DI	Kennebeck Ave N	E James St	E Temperance St	\$255,000	34
44	467	12	DI, UNK	N State Ave	E George St	E James St	\$164,000	33
45	1,158	12	AC, CI, DI	Clark Ave N	E James St	E Temperance St	\$406,000	37
46	8,464	8, 12, 16	CI, DI	Riverbend Industrial Area	Central Pl S	S 259th St	\$2,927,000	39
47	3,739	12, 16	CI	S 259th St	5th Ave S	88th Ave S	\$1,349,000	43
48	1,939	8	CI, UNK	E Chicago St, Wynwood Dr, Marion St	Van De Vanter Ave	Van De Vanter Ave	\$614,000	43
49	297	12	CI	W Titus St	Central Ave S	Railroad Ave S	\$104,000	46
50	1,995	8	CI, DI, UNK	E Chicago St	Van De Vanter Ave	Woodland Way	\$622,000	38
51	609	12	CI, UNK	Summit Ave N, Canyon Dr	E Smith St	Weiland St	\$214,000	40
52	284	12	CI	E Pioneer St	Railroad Ave N	Central Ave N	\$100,000	46
53	1,855	12	CI	Hazel Ave N, Stetson Ave	E James St	Dead-end	\$650,000	36
54	2,037	16, 21	CI, DI, UNK	104th Ave SE	SE 234th Pl	SE 240th St	\$788,000	35
55	2,914	16	CI, DI, UNK	108th Ave SE, SE 260th St	Kent Kangley Rd	SE 264th St	\$1,117,000	33

(1) UNK = unknown material

(2) Cost estimates for CIP Nos. 14, 53, and 55 include seismically restrained water main.

(3) Recommended to improve water quality and provide looping; no existing level-of-service deficiencies adjacent to proposed improvement alignment.

OTHER IMPROVEMENTS

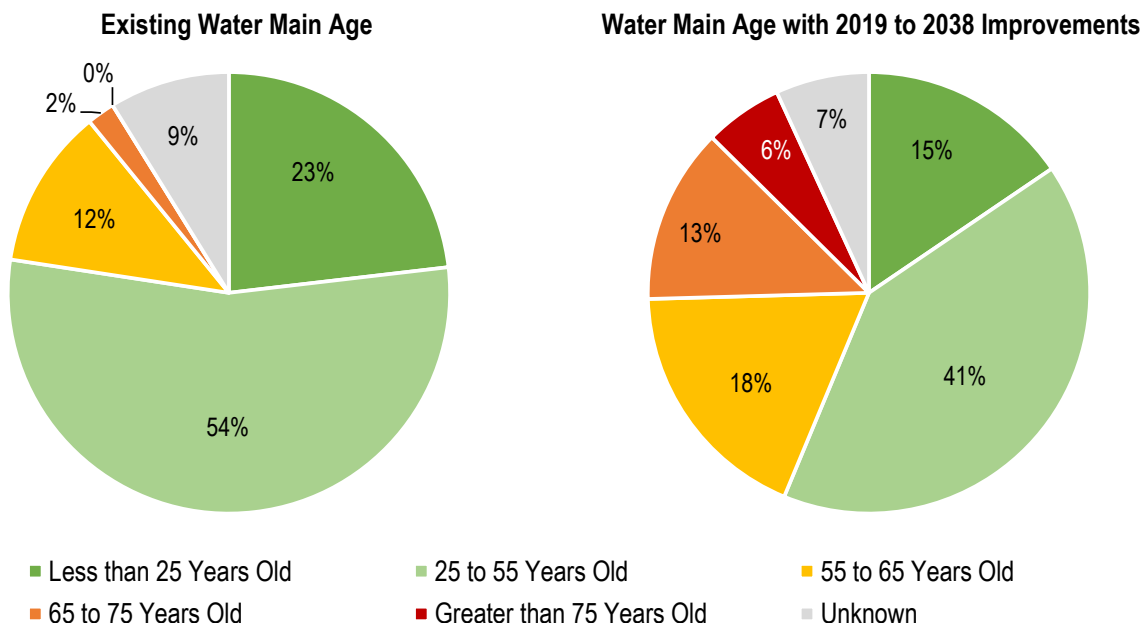
The additional water main, pressure zone, and facility improvements were prioritized based on existing deficiencies, safety concerns, and maintenance and capacity requirements. The miscellaneous improvements were prioritized based on regulatory requirements, funding availability, and an assessment of other water system needs. The priority order of these improvements is reflected in the schedule of improvements presented in the next section. **Figures 9-16** through **9-22** present all City-identified and distribution system replacement projects necessary to meet the City's 2019 design criteria. Water main replacement projects categorized as medium and low priority projects are not specifically funded within the 20-year planning period. These projects are anticipated to be completed within the 20-year planning period only if they are developer funded and determined to be necessary for redevelopment. High priority water main replacement projects necessary to meet the City's 2019 design criteria are endeavored to be replaced by the City within the 20-year planning period, but if specific schedules for the replacement of these water mains are necessary for redevelopment, these specific projects will be developer funded.

SCHEDULE OF IMPROVEMENTS

The improvement prioritization results were used to assist in establishing an implementation schedule that can be used by the City for preparing its 10-year CIP and annual water budget. The implementation schedule for the proposed improvements is shown in **Table 9-5**. An average allowance of approximately \$2,200,000 per year has been established for the annual replacement of high priority water mains. The City will identify and schedule the replacement of these water mains during its annual budget process. This provides the City with the flexibility to coordinate these projects with road or other projects in the same areas. Should the completion of a high priority water main replacement project be necessary for development or redevelopment at a schedule that differs from the schedule identified by the City during its annual budget process, the project shall be developer funded.

As the existing infrastructure continues to age, managing and funding the water system CIP is essential to maintaining a safe and reliable water supply for the City's customers. Based on the existing level of repair and replacement identified by the City for the water system CIP, the amount of water main in the system that is greater than 65 years old will increase from 2 percent to 19 percent by the end of the 20-year planning period, as shown in **Chart 9-2**. As funding becomes available, the City should consider a more aggressive water main repair and replacement program or continue to develop asset management strategies to address future infrastructure needs.

Chart 9-2
Existing and Future Water Main Age



FUTURE PROJECT COST ADJUSTMENTS

All cost estimates shown in the tables are presented in year 2019 dollars. It is recommended that future costs be adjusted to account for the effects of inflation and changing construction market conditions at the actual time of project implementation. Future costs can be estimated using the Engineering News Record (ENR) Construction Cost Index for the Seattle area or by applying an estimated rate of inflation that reflects the current and anticipated future market conditions.

Table 9-5
Proposed Improvements Implementation Schedule

No. Description		Estimated Cost (2019 \$)	20-Year Schedule of Improvements Planned Year of Project and Estimated Cost in 2019 \$												
			Prior to 2019	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029-2038	Beyond 2038
Water Main Improvements															
WM1	Annual Water Main Replacement Program - High Priority	\$44,876,000		\$1,960K	\$1,500K	\$400K	\$400K	\$698K	\$535K	\$3,365K	\$3,465K	\$2,765K	\$2,855K	\$26,433K	\$500K
WM2	Veterans Drive and Military Road Transmission Main	\$6,000,000				\$1,100K	\$1,100K	\$2,150K	\$1,650K						
WM3	Reith Road Transmission Main Improvements	\$500,000							\$500K						
WM4	68th Avenue S Transmission Main Improvements	\$12,890,000													\$12,890K
WM5	S 212th Street Transmission Main Improvements	\$6,900,000													\$6,900K
WM6	84th Avenue S Transmission Main Improvements	\$9,180,000													\$9,180K
WM7	Guiberson Reservoir Transmission Main Improvements	\$5,000,000												\$5,000K	
WM8	78th Avenue S Water Main Improvements	\$2,000,000										\$2,000K			
WM9	88th Avenue S Water Main Improvements	\$490,000	\$490K												
WM10	S 218th Street Transmission Main Improvements	\$930,000	\$930K												
WM11	SE 284th Street Water Main Improvements	\$1,810,000											\$1,810K		
WM12	640 Zone BPS #2 Transmission Main Improvements	\$2,230,000					\$1,115K	\$1,115K							
WM13	590 Zone Transmission Main Downstream of Tacoma POD #3	\$980,000							\$980K						
Pressure Zone Improvements															
PZ1	Military Road Connection Between 587 and 575 Zones	\$1,220,000												\$1,220K	
PZ2	640 Zone Conversion	\$2,920,000	\$2,171K			\$749K									
Facility Improvements															
F1	West Hill BPS	\$2,800,000						\$1,000K	\$1,400K	\$400K					
F2	West Hill Reservoir	\$12,500,000	\$132K	\$8,200K		\$2,916K	\$1,050K	\$202K							
F3	West Hill PRVs and Altitude Valves	\$800,000								\$400K	\$400K				
F4	640 Zone BPS #1 (Blue Boy Standpipe Site)	\$3,250,000	\$3,250K												
F5	640 Zone BPS #2 (Tacoma POD #3 Site)	\$3,000,000			\$1,500K	\$1,500K									
F6	125K Tank Exterior Recoating	\$1,300,000	\$1,300K												
F7	Guiberson Reservoir Replacement	\$12,000,000												\$12,000K	
F8	Garrison/O'Brien Treatment Plant	\$1,300,000								\$1,300K					
Miscellaneous Improvements															
M1	Generator Improvement Program	\$2,000,000			\$1,000K					\$1,000K					
M2	Reservoir Maintenance and Improvement Program	\$10,000,000	\$546K	\$100K		\$500K	\$500K	\$500K	\$500K	\$500K	\$500K	\$500K	\$500K	\$5,354K	
M3	Tacoma Regional Water Supply System (RWSS)	\$1,338,000	\$338K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$500K	
M4	Transmission Main Easements/Land Acquisitions	\$1,000,000	\$108K	\$150K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$50K	\$292K	
M5	Water System Plan Update	\$915,000	\$115K									\$400K	\$400K		
M6	Watershed Control Plan, Habitat Conservation Plan, and Wellhead Protection Program	\$8,000,000	\$2,964K	\$1,222K	\$413K									\$3,401K	
M7	Landsburg Mine Management	\$2,026,000	\$132K	\$790K	\$804K									\$300K	
M8	Automatic Meter Reading System	\$3,000,000												\$3,000K	
M9	PLC Upgrade Program	\$770,000	\$70K	\$35K	\$35K	\$35K	\$35K	\$35K	\$35K	\$35K	\$35K	\$35K	\$35K	\$350K	
M10	SCADA System Upgrades	\$500,000	\$150K						\$100K				\$100K	\$150K	
M11	Well Rehabilitation Program	\$4,087,000		\$212K	\$275K	\$200K	\$200K	\$200K	\$200K	\$200K	\$200K	\$200K	\$200K	\$2,000K	
Total Estimated Costs of City Funded Improvements		\$168,512,000	\$12,696K	\$12,719K	\$5,627K	\$6,000K	\$6,000K	\$6,000K	\$6,000K	\$6,000K	\$6,000K	\$6,000K	\$6,000K	\$60,000K	\$29,470K

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